

Analysis of the Needs for Development of Teaching Materials Based on Education for Sustainable Development (ESD) on Chemistry Materials for Class X SMA/MA

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Abstract

In this study there is a goal to determine the need for the development of ESD-based teaching materials, because based on the results in the field there is a lack of development of teaching materials in class X chemistry material. This research uses descriptive qualitative research methods, with data collection through interviews, documentation studies. This analysis includes curriculum analysis, teaching material analysis and learner analysis. Based on the results of the analysis conducted, this study shows that the teaching materials used today still do not meet the needs of students who are still in the form of package books from schools and lack of development from teachers so that the teaching materials used in learning only come from print-based book sources, thus researchers will develop teaching materials that contain the three pillars of ESD.

Keywords: Needs Analysis, Teaching Materials, ESD, Chemistry.

A. INTRODUCTION

Education is defined as an activity to contain goals and how these goals can stimulate the potential of both individuals and groups (Nurkholis, 2013). The learning process in Indonesia has not been fully achieved according to the Program for International Students Assessment (PISA) survey of the ability of literacy and numeracy students who are taken randomly sampled 15-year-old students that since 2009 - 2015 there has been no significant increase in ability. The results of three surveys show that the ability of students in Indonesia in mathematical literacy is very low (Ayuningtyas & Sukriyah, 2020). PISA is seen as a program that provides benefits for education and the application of education. The presence of PISA as a reflection for policy makers in a country. Thus, because it is seen from several PISA surveys that the low literacy and numeracy skills of students, there must be an integration of learning based on Education for Sustainable Development or education for sustainable development which is a benchmark for Sustainable Development Goals (SDGs) or sustainable development goals.

Education for Sustainable Development is seen to provide an understanding to a person (learner) in making decisions and actions by improving our quality of life without compromising the planet (Tristananda, 2018). Education for Sustainable Development (ESD) plays an important

role in the learning process because as explained, it is based on 3 pillars of environment, economy, and social.

In the process of implementing ESD, it must be supported by several aspects in learning, one of which is learning tools, namely teaching materials. Teaching materials function as learning media used to maximize the learning process so that the learning process can run effectively (Pawestri & Zulfiati, 2020). In addition, the preparation of teaching materials consists of 3 requirements, didactic, construction and technical requirements. However, the reality in the field is different, in a preliminary study conducted at SMA Negeri 7 Lhokseumawe, through the results of observations, and interviews explained that teaching materials are still in printed form and the lack of development of teaching materials carried out by teachers in making electronically due to limited digital access and technological capabilities.

The development of technology is advancing so rapidly that it is commonly called the 21st century, this era is seen as a human necessity in using or mastering technology, because all aspects require technology, one of which is the aspect of education (Purnama & Suparman, 2020) besides in printed form there are also teaching materials in electronic form or commonly called e-Teaching Materials (e-Book), the difference is in terms of operation which usually uses paper, for electronics it can use computers, cellphones, smartphones, notebooks. The use of teaching materials in learning makes learning attractive to students and interactive. The advantages of teaching materials according to several experts are that they provide convenience and narrow the space and time so that learning becomes more effective (Suryaningsih et al., 2021). In addition, according to (Nirmayani, 2022) electronic teaching materials can save costs in printing and provide easy access through devices such as cellphones, laptops, and others. In addition, the presentation is more interactive so that students become more interested in doing it.

The environment is the most important aspect in the life of living things, thus we must pay attention to environmental issues by integrating them into learning tools, so that they can be applied in children's daily lives. Chemistry is seen as a difficult learning at this time. This material also makes students less interested in the learning process.

In previous research conducted by (Tressyalina & Dkk, 2022) discussed the process of analyzing the needs of interactive e-LKPD based on local wisdom in Indonesian language lessons aimed at high school students. In addition, the research (Prabandari et al., 2022) discusses the needs analysis of the development of LKPD in science subjects for elementary school students. In line with that in research (Endah & Hidayat, 2022) based on electronics regarding the needs analysis of e-LKPD.

Based on the studies that have been described, researchers are interested in analyzing the needs of ESD-based Teaching Materials for class X chemistry material, with the hope that it can provide benefits to everyone and indirectly have an influence on increasing students' understanding, in addition to attracting students' attention when the learning process takes place, so that students can feel happy when learning to use learning tools, so that later it will have an impact on student learning outcomes. The subjects consisted of 4 chemistry teachers and 10 students at SMA Negeri 7 Lhokseumawe.

B. RESEARCH METHOD

In this study, researchers used descriptive qualitative research methods. This research was conducted within a period of time from October 16, 2024 in the research process, the researcher involved several subjects, for the subjects were selected based on problem analysis and identifying teachers and students at SMA Negeri 7 Lhokseumawe. The selection of subjects was analyzed through research problems and the process of identifying the characteristics of teachers and students. The criteria for teachers who are used as informants are: 1) Have a minimum teaching experience of 2 years. 2) Have adequate professional qualifications, for example, the last education is at least S1. 3) Have knowledge according to the material they teach. 4) Have technological science skills (Yanti & Hamdu, 2021).

The data sources in this research come from primary data and secondary data. Primary data is obtained through informants who are in accordance with the research. If secondary data is obtained from the observation process when implementing learning, in addition to documentation studies regarding learning outcomes, teaching materials, LKPDs that are implemented as well as data that supports research.

The research procedure carried out by the researcher will be depicted in the following figure:

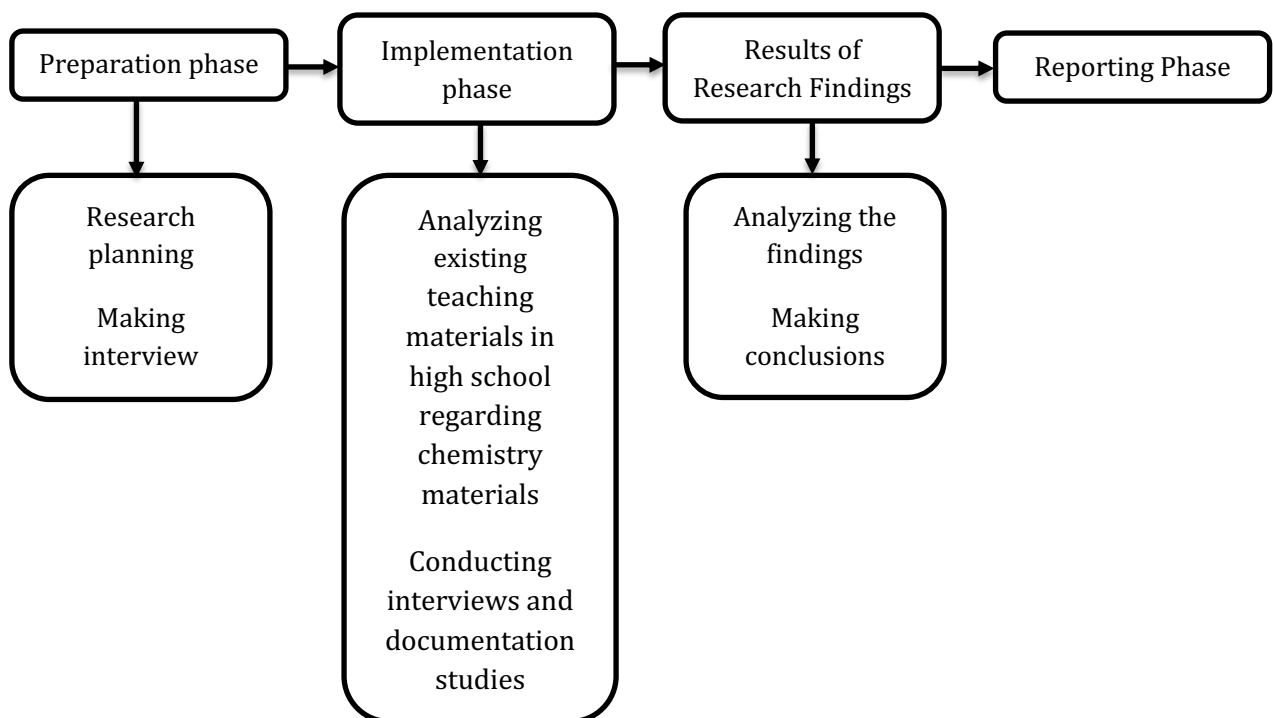


Figure 1. Research Procedure

The technique in obtaining data was carried out by researchers conducting interviews and documentation studies, data analysis in this study refers to qualitative data analysis according to Miles and Huberman. There are several stages in data analysis according to Miles and Huberman in (Sugiyono, 2017) including several stages, namely: data reduction, data display and conclusion and verifying

C. FINDINGS AND DISCUSSION

Through the process of analyzing several aspects, this research results in the following discussion:

Curriculum Analysis

The process of analyzing basic competencies was carried out by researchers for class V in accordance with the three pillars of ESD (Education for Sustainable Development) which included economic, social and environmental pillars. The researcher examined the learning outcomes of chemistry class X that contained the three ESD pillars. The Outcomes that contain environmental, economic and social pillars are contained in the following table:

Table 1. Outcomes of Learning Outcomes of Chemistry Class X Basic ESD Concepts.

Economic Pillar	Understanding Resource Economics: Students are able to explain the importance of sustainable management of natural resources in the chemical industry.
	Cost and Benefit Analysis: Students can identify and analyze the costs and benefits associated with the use of chemicals in the production process.
	Eco-Friendly Product Innovation: Students can develop ideas for products or methods that reduce environmental impact, prioritizing energy and raw material efficiency.
Environmental Pillar	Environmental Awareness: Students can explain the impact of certain chemicals on the environment and the importance of proper waste management.
	Green Chemistry Practices: Students understand and can apply the principles of green chemistry to reduce pollution and negative impacts on the ecosystem.
	Understanding the Life Cycle of Chemical Products: Students can explain the concept of the life cycle of chemical products from raw materials to disposal, as well as its impact on the environment.
Social Pillar	Social Responsibility in Chemical Use: Students can identify the social responsibility required in the use and management of chemicals to protect public health.
	Health and Safety Awareness: Students understand the importance of safe chemical use in society and how to mitigate health risks that can arise from daily chemical use.
	Collaboration in Environmental Conservation: Students can work together in groups to plan and implement projects that focus on reducing the environmental impact of chemicals.

The results show that in class X, the ESD concept has been integrated, but the implementation has not been carried out simultaneously in one lesson. So it can be concluded that the implementation of ESD has been implemented but separately, in research conducted (Listiwati et al., 2013) which states that the implementation of ESD in Indonesia is only to the environmental pillar, has not integrated the economic and social pillars. For the design of ESD implementation, it is integrated in chemistry subjects with the Learning Outcomes that have been written above.

Analysis of teaching materials used

Based on the results of the analysis, the teaching materials applied by most high schools in Lhokseumawe City are teaching materials published by Erlangga. The results of the analysis of

teaching materials in chemistry books still contain stimulus cognitive aspects, and there are still too many exercises, which consist of three requirements, namely didactic, technical, construction requirements. In line with that (Septian et al., 2019) explained from the results of observations and interviews with elementary school educators at SDN 3 Karangnanas, SDN 1 Ledug, and SDN Wiradad explained that materials only buy from subscriptions that are used to coming to school so there is no development of teaching materials from educators, and he explained that these teaching materials have not motivated students to learn so that it has an impact on students' desire to learn and become passive and lack of understanding of the material. In line with that (Haryanto et al., 2022) explained the problems experienced by educators in elementary schools in the Sendangtirto Sleman Cluster that in the learning process teaching materials are rarely involved or rarely use teaching materials besides that when using teaching materials, the teaching materials used still contain material and practice questions so that students lack information and knowledge. So, this makes learning less optimal and not meaningful. In addition, teaching materials are learning tools that are seen to facilitate students so that they can better understand the learning material. (Salsabila et al., 2022).

Student Analysis

The results of interviews with 10 class X students at SMA Negeri 7 Lhokseumawe show that students want an innovative teaching material that is not only print-based but the use of cellphones in implementing learning and can be done at home, besides that the appearance is attractive and there are many pictures or videos. Piaget explains that student learning outcomes will be maximized when learning is in accordance with the stage of cognitive development of students, thus because high school age enters the concrete operational stage, learning must be supported by concrete media to make it easier for students with the material they learn (Agung, 2019). Based on this explanation, the teaching materials developed must contain concrete media and be in accordance with the cognitive development of high school students.

Interview Results to Class X Teacher

The results of the interviews were conducted with 4 grade X teachers. The interview is divided into several discussions regarding: the use of teaching materials, integrating sustainable development, the need for electronic development of teaching materials and the need for E-Books on global warming material as a crucial environmental issue. Through the results of the interview, there is a data collection process that the use of teaching materials is very important because to measure the achievement of understanding the subject matter, with teaching materials educators can see the work process of students. Teaching materials are seen as teaching materials, if in the learning process there are no teaching materials, educators can have difficulty in achieving learning objectives, so that later it will have an impact on student learning outcomes that are less than optimal (Aisyah et al., 2020).

In the application of teaching materials in the form of e-Books in public high schools located in cities and in Lhokseumawe City, it is evident through documentation studies that the application of learning using e-Books from Erlangga published chemistry books only.. Educators explained that there was no ESD-based e-book on chemistry material, usually the existing teaching materials were only filling in the lack of understanding stimulus and lack of visual elements. This is in line with research conducted (Wandari et al., 2018) explaining that student worksheets usually do not attract students' attention due to the lack of images and colors so that they look monotonous, thus having

an impact on students' sense of desire to learn. In line with that (Nareswari et al., 2021) explained that if learning still uses conventional teaching materials, it will have an impact on teaching and learning activities, because students lack motivation in the implementation of learning because the teaching materials used have not provided a student-centered learning experience.

Furthermore, because now the use of technology is advancing so rapidly, the learning process must also be supported by technology assistance in order to increase students' desire to learn and be able to adapt to the 21st century. Implementation of technology in learning can be done by using electronic-based teaching materials, and students work on them via cellphones or computers. Referring to the Program for International Student Assessment (PISA), there is a shift in assessment from computer-based paper, in the trial it is explained that learning that utilizes technology scores higher when compared to students who use paper assessments (Kemendikbud, 2019).

According to (Puspita & Dewi, 2021) the use of E-Books in learning makes students' learning activities less boring, besides that learning becomes interactive, so that students are more motivated in their desire to learn. In line with that, according to (Pribadi et al., 2021) E-Books make it easier for educators to explain material so that students can access it anywhere. Learning in the Merdeka curriculum, especially in class X, all teachers have agreed that there is chemistry material, although in its separate application it is contained in one lesson (Listiawati et al., 2013). Thus, the independent curriculum already contains the pillars of *Education for Sustainable Development* (ESD), but all teachers who are resource persons do not know this. According to (Tristananda, 2018) *Education for Sustainable Development* (ESD) based learning must be implemented in all levels of education, because ESD can meet the needs of the present and without sacrificing for the future.

The concept of ESD is seen as a meaningful education because it functions and aims to 1) ESD education is seen as an education that is able to meet the needs of the present generation without excluding the ability of future generations to meet their needs 2) ESD education can improve the quality of human life within the carrying capacity of the ecosystem 3) ESD education can provide benefits for humans and ecosystems in the present and the future (Depdiknas, 2009).

The Intergovernmental Panel on Climate Change (IPCC) explained that in 2007 the temperature increased by 0.74 approximately 0.32 degrees Celsius, global warming is identical to the increase in temperature and, the most cause of the increase in temperature is caused by greenhouse gases such as industrial smoke, motor vehicles, ships, airplanes and others. Besides the cause of global warming occurs due to natural factors such as: volcanic eruptions, climate dynamics in the atmosphere and oceans (Aldrian et al., 2011). We have felt the impact of global warming such as climate change, warming of the earth's temperature, melting of polar ice caps, sea level rise, expansion of deserts, increased rain and flooding, and extinction of flora and fauna. From this exposure, there must be sustainable efforts integrated into learning in elementary schools regarding global warming material, namely by doing small things such as using bicycles for closer distances, saving electricity use, reforestation and reusing, reduce, and recycle. The goal is to prevent global warming.

For the self-learning process, educators can integrate ESD into teaching materials for students, for example, ESD concepts are included in teaching materials for students' guidance in learning.

The results of this study are that researchers know the needs regarding LKPD that should exist in elementary schools, because in previous research (Endah & Hidayat, 2022) examined an electronic-based needs analysis regarding e-Books that were not ESD-based and character-based

and not in chemistry. So that researchers analyze ESD-based E-Books for chemistry material so that the results of this further research by developing interactive E-Books which include efforts to deal with or reduce chemistry and know the impact of using chemicals and their causes.

By conducting interviews and documentation studies, researchers know about the needs of the products that will be developed by researchers. In addition, knowing the findings regarding the need for e-Books is a challenge in itself due to the lack of learning tools available at school, because this research focuses on learning that is carried out independently by adjusting technological developments

D. CONCLUSION

Based on the results of the research that has been conducted by researchers, the researchers can conclude that the use of teaching materials in schools has not met the needs of students, because usually chemistry material is taught in less detail and there is no e-book on ESD-based chemistry material, so educators and students need ESD-based e-Books on chemistry material for high school students to support teaching and learning activities. This research is required to conduct further research so that later the final results of the research will get an ESD-based electronic book for grade X high school students.

REFERENCES

- Agung, R. (2019). Analisis Teori Perkembangan Kognitif Piaget Pada Tahap Anak Usia Operasional Konkret 7-12 Tahun Dalam Pembelajaran Matematika. *Al-Adzka: Jurnal Ilmiah Pendidikan Guru Madrasah Ibtidaiyah*, 9(1), 27–34. <https://Core.Ac.Uk/Download/Pdf/327227393.Pdf>
- Aisyah, S., Noviyanti, E., & Triyanto. (2020). Bahan Ajar Sebagai Bagian Dalam Kajian Problematika Pembelajaran Bahasa Indonesia. *Jurnal Salaka*, 2(1), 62–65. <http://Dx.Doi.Org/10.1038/S41598-019-525471%0a>
- Aldrian, E., Karmini, M., & Budiman. (2011). Adaptasi Dan Mitigasi Perubahan Iklim Di Indonesia (1st Ed., Issue 2). Pusat Perubahan Iklim Dan Kualitas Udara Kedeputan Bidang Klimatologi Badan Meteorologi, Klimatologi, Dan Geofisika.
- Ayuningtyas, N., & Sukriyah, D. (2020). Analisis Pengetahuan Numerasi Mahasiswa Matematika Calon Guru. *Delta-Pi: Jurnal Matematika Dan Pendidikan Matematika*, 9(2), 237–247. <https://Doi.Org/10.33387/Dpi.V9i2.2299>
- Depdiknas. (2009). *Model Pelaksanaan Esd Melalui Kegiatan Intrakurikuler* (Nadiroh, Z. Arifin, & Mahdiansyah (Eds.)). Puslitjaknov.
- Endah, A. P., & Hidayat, S. (2022). Analisis Kebutuhan E-Lkpd Berbasis Hots Bermuatan Karakter. *Pedadidaktika: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar Analisis*, 9(2), 304–311.
- Haryanto, H., Wuryandani, W., Suwarjo, S., Hidayah, R., Erviana, V. Y., & Mahfuzah, A. (2022). Pendampingan Penyusunan Lkpd Berbasis Scientific Approach Pada Guru Sekolah Dasar. *Dedikasi: Community Service Reports*, 4(1), 18–30. <https://Doi.Org/10.20961/Dedikasi.V4i1.55996>
- Kemendikbud. (2019). Pendidikan Di Indonesia Belajar Dari Hasil Pisa 2018. *Pusat Penilaian Pendidikan Balitbang Kemendikbud*, 021, 1–206. <http://Repositori.Kemdikbud.Go.Id/Id/Eprint/16742>
- Listiawati, N., Kebijakan, P. P., & Kemdikbud, B. (2013). *The Implementation Of Education For Sustainable Development By Several Agencies*. 19(September), 430–450.
- Nareswari, N. L. P. S. R., Suarjana, I. M., & Sumantri, M. (2021). Belajar Matematika Dengan Lkpd Berbasis Kontekstual. *Mimbar Ilmu*, 26(2), 204. <https://Doi.Org/10.23887/Mi.V26i2.35691>

- Nirmayani, L. H. (2022). Kegunaan Aplikasi Liveworksheet Sebagai Lkpd Interaktif Bagi Guru-Guru Sd Di Masa Pembelajaran Daring Pandemi Covid 19. *Edukasi: Jurnal Pendidikan Dasar*, 3(1), 9. <https://doi.org/10.55115/Edukasi.V3i1.2295>
- Nurkholis. (2013). Pendidikan Dalam Upaya Memajukan Teknologi Oleh: Nurkholis Doktor Ilmu Pendidikan, Alumnus Universitas Negeri Jakarta Dosen Luar Biasa Jurusan Tarbiyah Stain Purwokerto. *Jurnal Kependidikan*, 1(1), 24–44. <http://ejournal.iainpurwokerto.ac.id/index.php/jurnalkependidikan/article/download/530/473/>
- Pawestri, E., & Zulfiati, H. M. (2020). Pengembangan Lembar Kerja Peserta Didik (Lkpd) Untuk Mengakomodasi Keberagaman Siswa Pada Pembelajaran Tematik Kelas Ii Di Sd Muhammadiyah Danunegaran. *Trihayu: Jurnal Pendidikan Ke-Sd-An*, 6(3). <https://doi.org/10.30738/Trihayu.V6i3.8151>
- Prabandari*, L., Fuadi, D., Sumardi, S., Minsih, M., & Prastiwi, Y. (2022). Analisis Kebutuhan Pengembangan Lkpd Ipa Berbasis Eksperimen Sains Untuk Meningkatkan Minat Belajar Siswa Di Sekolah Dasar. *Jurnal Pendidikan Sains Indonesia*, 10(4), 694–704. <https://doi.org/10.24815/jpsi.V10i4.26108>
- Pribadi, Y. T., Sholeh, D. A., & Auliaty, Y. (2021). Pengembangan E-Lkpd Materi Bilangan Pecahan Berbasis Problem Based Learning Pada Kelas Iv Sekolah Dasar. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 2(2), 264–279. <https://doi.org/10.37478/jpm.V2i2.1116>
- Purnama, A., & Suparman. (2020). *Studi Pendahuluan : E-Lkpd Berbasis Pbl Untuk Meningkatkan Kemampuan Literasi Matematis Peserta Didik*. 2682(1), 131–140.
- Puspita, V., & Dewi, I. P. (2021). Efektifitas E-Lkpd Berbasis Pendekatan Investigasi Terhadap Kemampuan Berfikir Kritis Siswa Sekolah Dasar. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(1), 86–96. <https://doi.org/10.31004/Cendekia.V5i1.456>
- Salsabila, S., L, E. N., & Muharram, M. R. W. (2022). Pengembangan Perangkat Pembelajaran Menggunakan Pendekatan Gamification Berbasis Marczewski's Framework Di Sekolah Dasar. *Collase (Creative Of Learning Students Elementary Education)*, 5(4), 688–702.
- Septian, R., Irianto, S., & Andriani, A. (2019). Pengembangan Lembar Kerja Peserta Didik (Lkpd) Matematika Berbasis Model Realistic Mathematics Education. *Jurnal Educatio Fkip Unma*, 5(1), 59–67. <https://doi.org/10.31949/Educatio.V5i1.56>
- Sugiyono. (2017). Metode Penelitian Kuantitatif Kualitatif Dan R&D. In Alfabeta (26th Ed.). Alfabeta Bandung.
- Suryaningsih, S., Nurlita, R., Islam, U., Syarif, N., & Jakarta, H. (2021). Pentingnya Lembar Kerja Peserta Didik Elektronik (E-Lkpd) Inovatif Dalam Proses Pembelajaran Abad 21. 2(7), 1256–1268.
- Tressyalina, & Dkk. (2022). Analisis Kebutuhan E-Lkpd Interaktif Berbasis Kearifan Lokal Dalam Pembelajaran Teks Eksposisi. *Educaniora*, 1(1), 25–34. <https://persona.ppi.unp.ac.id/index.php/prsn/article/view/111>
- Tristananda, P. W. (2018). Membumikan Education For Sustainable Development (Esd) Di Indonesia Dalam Menghadapi Isu-Isu Global. *Purwadita: Jurnal Agama Dan Budaya*, 2(2), <http://jurnal.stahnmpukuturan.ac.id/index.php/purwadita/article/view/86>
- Utina, R. (2009). Pemanasan Global: Dampak Dan Upaya Meminimalisasinya. *Jurnal Saintek*, 3(3), 1–11. <https://doi.org/10.1016/B978-008046620-0/50035-9>
- Wandari, A., Kamid, K., & Maison, M. (2018). Pengembangan Lembar Kerja Peserta Didik (Lkpd) Pada Materi Geometri Berbasis Budaya Jambi Untuk Meningkatkan Kreativitas Siswa. *Edumatika : Jurnal Riset Pendidikan Matematika*, 1(2), 47. <https://doi.org/10.32939/Ejrpm.V1i2.232>
- Yanti, N. H., & Hamdu, G. (2021). Analisis Kebutuhan Pengembangan Elektronik Modul Berbasis Education For Sustainable Development Untuk Siswa Di Sekolah Dasar. *Edukatif: Jurnal Ilmu Pendidikan*, 3(4), 1821–1829. <https://edukatif.org/index.php/edukatif/article/view/632>